THE GROWTH OF SAROTHERODON (TILAPIA) NILOTICULS L. IN OPA RESERVOIR, UNIVERSITY OF IFE, ILE-IFE, NIGERIA

by

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ABSTRACT

The growth of Sarotherodon (Tilapia) niloticus (Linnaeus) in Opa Reservoir, University of Ife was determined from the fish scales. Compared with the growth in other similar water bodies the growth was comparatively faster in this newly - impounded reservoir.

INTRODUCTION

A thorough knowledge of the growth of tropical fishes is important in all aspects of fish production. Age and growth studies are particularly important for describing the status of a fish population and for predicting the potential of a fishery. Though a fairly extensive literature exists on the age and growth of temperate fishes, only little information is available on tropical fishes.

Age and growth determination in fishes is particularly critical in the tropical waters where the seasons are not sharply demarcated as in the temperate waters. In the tropics water temperatures vary only slightly, several fish species spawn many times in a year, many water bodies are subjective to a regular rise and fall and as such formation of growth marks on scales and other hard bony parts is therefore not certain.

Holden (1955) reported that rings are formed by irregular cerculi in Tilapia variabibis and T. esculenta of Lake Victoria. Annual marks have also been reported to be found on the scales of Tilapia nilotica as well as T. galilaea and T. zilli by Jensen (1957). Salinity changes have also been attributed to growth ring formation in Tilapia melanotheron by Fagade (1974).

There are a series of reservoirs springing up all over Nigeria. There is no doubt that many more reservoirs will be built to satisfy the specific needs for irrigated agriculture in the Green Revolution Programme. Reservoir fish culture is fast becoming prominent. Many reservoirs have great potential for fish culture. A knowledge of the age and growth of the indigenous reservoir fish population will be necessary for commercial fish production.

The attempt made to determine the growth of Sarothrodon niloticus in Opa Reservoir, University of Ife is here presented.

SITE, MATERIALS AND METHODS

Site

This study was carried out in Opa Reservoir, University of Ife, Ile-Ife. The reservoir which was formed by impounding River Opa in 1978 was constructed principally to supply water for domestic consumption to the entire University community.

The reservoir has a catchment area of about 116 square kilometers. It lies between latitude 7° 21' and 7° 35' N and longitude 4° 31' and 4° 39' E. Most of the land area drained by the reservoir are the University research farm and tradi tional farm lands. The fertilizers used on these farm lands serve as a rich source of nutrients for the water body. The reservoir is enclosed in a fairly thick forest except at the dam site. A lot of vegetation was submerged by the impoundment.

Materials and Methods

Specimens of Sarotherodon niloticus investigated in this study were collected between January 1980 and October 1981. The fishes were sampled mainly by gillnets and castnets and then transferred to the laboratory.

Total and standard lengths of the fishes were measured to the nearest milimeter while the weights were also measured to the nearest gram and recorded. Scale samples were removed from selected fish specimens by scrapping the body surface with a blunt knife. The scales were always removed from a small area on the left side just in front of the dorsal fin and above the lateral line. These scales were preserved in small envelopes on which fish measurement were written for later identification. Opercular bones and prehaemal vertebrae were also removed from a few fish specimens.

The scales were cleaned in 10% ammonia solution while the opercular bones and vertebrae were cleaned in boiled water. The cleaned scales were later dried and an average of five scales from each fish specimen were mounted between two glass slides and labelled.

Among the three hard structures collected for growth studies, the scales were found most suitable because of the distinctness of the growth marks. The growth marks on the opercular were obscure and the vertebrae rings were used only to confirm the ages of the fishes. Annuli on the fish scales were identified by a change in the growth configuration. The radius of each scale was measured. The number of annuli on each scale and the radius of each annulus was also recorded.

The radius of each scale was plotted against the corresponding standard length. From the resulting regression line, the growth in length was obtained by back-calculation.

RESULTS

Size Composition

During this period of study, a total number of 553 specimens of Sarotherodon niloticus were caught. Among these, 190 specimens were examined for growth.

The sizes of the fish caught ranged from a minimum total length, standard length and weight of 14.1 cm, 11.1 cm, and 52 gm respectively to a maximum of 37.0cm, 32.0 cm and 908 gm, total length, standard length and weight respectively. The apparent absence of smaller size fish specimens can be attributed to the selectivity of our sampling gears.

Annulus Formation on the Scales

The formation of annual rings on the scales was identified by the presence of the 'crossing-over' phenomenon of the cerculi. Observations made on the scales revealed that annual rings were laid between the months of December and February. These were the months when the annual rings were being laid at the edge of the scales.

Growth in Length

In this study, standard length measurements were used in preference to total length measurements of fish because many fish specimens were caught with partly mutilated tail fins. Standard lengths measurements are therefore more reliable than the total lengths.

Length is a more reliable indicator of growth than weight because length once achieved is not lost but weight can be due to seasonal variations and physiological state. The growth of scales is proportional to the growth in length of fish and as such growth measurements will be determined from the scale growth measurements.

There was a significant correlation ($r = 0.98$, p 0.001) between the logarithms of scale radius and fish length as shown in Fig. 1. From the regression line drawn through the plotted points, the growth in length of the fish was obtained by back-

calculation. The lengths of fish at each age of life are shown in Table 1 and Fig. 2. Growth was faster in the first year of life when the fish attained a standard length of 125 mm as compared with 73 mm, 54 mm and 44 mm respectively in the second, third and fourth years respectively. Growth was found to decrease with an increase in age.

Length-Weight Relationship and Condition Factor

The standard lengths of Sarotherodon niloticus were plotted against their corresponding weights and a regression line was drawn though these points as seen in Fig. 3. There was a significant correlation between them ($r = 0.98$ and p 0.001).

The length-weight relationship of fish can be conveniently represented by the equation: $w = aL^b$, where w = weight, L = length, a = constant and b = an exponent lying between 2 and 4. This equation can be represented as:-

$$\log w = \log a + b \log L.$$

From the regression line, the regression coefficient, b, was determined to be 2.839.

Table 1 - The mean back-calculated lengths and weights for the different age groups of Sarotherodon niloticus in Opa reservoir, University of Ife

Age	No. of fish in sample	Standard Length of fish (cm)	Weight of fish (gm)
I	190	12.5 ± 1.8	91
II	142	19.8 ± 1.7	338
III	104	25.2 ± 1.2	655
IV	32	29.6 ± 0.9	866

For an ideal fish, b = 3 (Le Cren, 1951). Tesch (1968) remarked that differences may occur in the length-weight relationship due to sex, maturity, season and even time of day due to stomach fullness. Variations in the length-weight relationship is usually referred to as the condition of the fish. The condition or 'condition factor' is expressed as:-

$$K = \frac{100w}{L^b}$$

where b = regression coefficient.

In Fig. 3, b = 2.839 which can be approximated to 3.

Hence $K = \frac{100w}{L^3}$

The monthly mean condition factor for Sarotherodon niloticus is shown in Table 2. From the table, is is obvious that the K values were high for all times of the year with a maximum of 4.40 and a minimum of 3.33. These high values are indicative of good condition of the fish all through the year. The relatively higher values might be attributed to the state of maturity of the fishes.

Growth in Weight

As seen in Table 1 and Fig 2, the growth in weight did not follow the pattern of the growth in length. Growth in weight was highest in the third year of life and least in the first year of life.

Table 2 - The monthly mean condition factor for Sarotherodon niloticus in Opa Reservpor, University of Ife

Month	Mean k.
January	3.91 ± 0.34
February	3.63 ± 0.23
March	3.50 ± 0.20
April	3.45 ± 0.38
May	4.12 ± 0.24
June	4.40 ± 0.42
July	3.94 ± 0.02
August	3.42 ± 0.24
September	3.70 ± 0.41
October	3.33 ± 0.31
November	3.56 ± 0.42
December	3.46 ± 0.31

DISCUSSION

Ring formation in Sarotherodon niloticus occurred in the months of July and August at the onset of floods in Rivers Niger and Sokoto (Banks et al., 1966). This is contrary to the result obtained in this study where the annual ring formation occurred during the months of December to February. This period coincides with the dry period of the year in Opa reservoir basin. Changes in the hydrological conditions and the extreme high temperatures might be responsible for the ring formation on the scales.

The growth of Sarotherodon niloticus in Opa Reservoir is relatively high when compared with the growth in River Niger and River Sokoto where they attained lengths of 20 cm and 15 cm total lengths in two years and first year of growth respectively (Banks et. al., 1966). As seen in Fig. 4, S. niloticus grew to total lengths of 16.5 cm and 24 cm in their first and second years of life. This growth was also higher than that recorded for S. niloticus in Lake Chad by Blache et al. (1964) where the fish attained sized of 13.4 cm, 22.9 cm, 28.0 cm and 31.8 cm in their first four years of life respectively. George (1976) reported that based on natural pond productivity, S. niloticus reached total lengths of 18-20 cm and 25 cm in 12 and 24 months respectively.

The growth of S. niloticus and other indigenous fishes in reservoirs will no doubt help to supply the much needed fish-protein for our growing population. This supply of fish from the reservoirs can be achieved through early planning along with the numerous reservoirs being built today for irrigation. Fish specialists should take part in the planning of dams.

George (1976) reported that S. niloticus can grow up to 32 cm total length in six months in ponds treated with a combination of super-phosphate and poultry manure. These sizes of fish can be attained in the numerous fish ponds and irrigation reservoirs springing up in Nigeria. In order to meet the target set for fish production in the Green Revolution Programme, there is need for maximum co-operation between our researchers, administrators and planners.

SUMMARY

A total of 190 specimens of Sarotherodon niloticus was examined for growth among the 553 specimens of this fish species caught between January 1980 and October 1981.

From back-calculations made on the fish scales, it was found that growth was highest in the first year of life but this decreased as the fish grows older. Compared with the growth in other similar bodies, the growth was comparatively faster in this newly-impounded reservoir.

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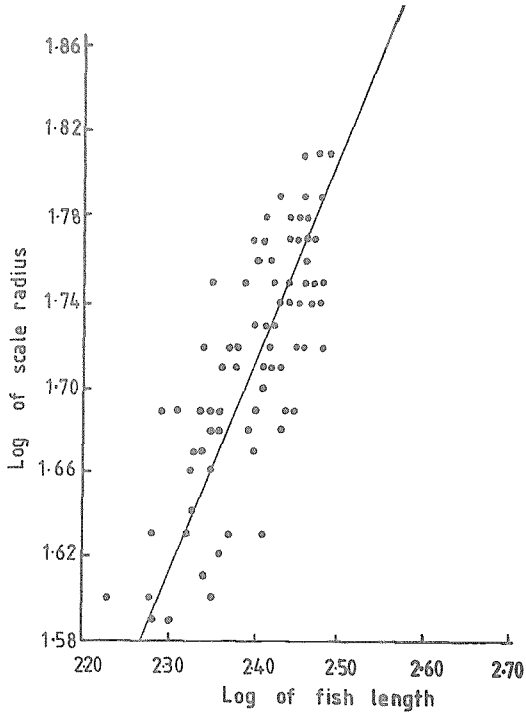


Fig. 1 Fish standard length/scale length relationship for Sarotherodon niloticus in Opa Reservoir, University of Ife.

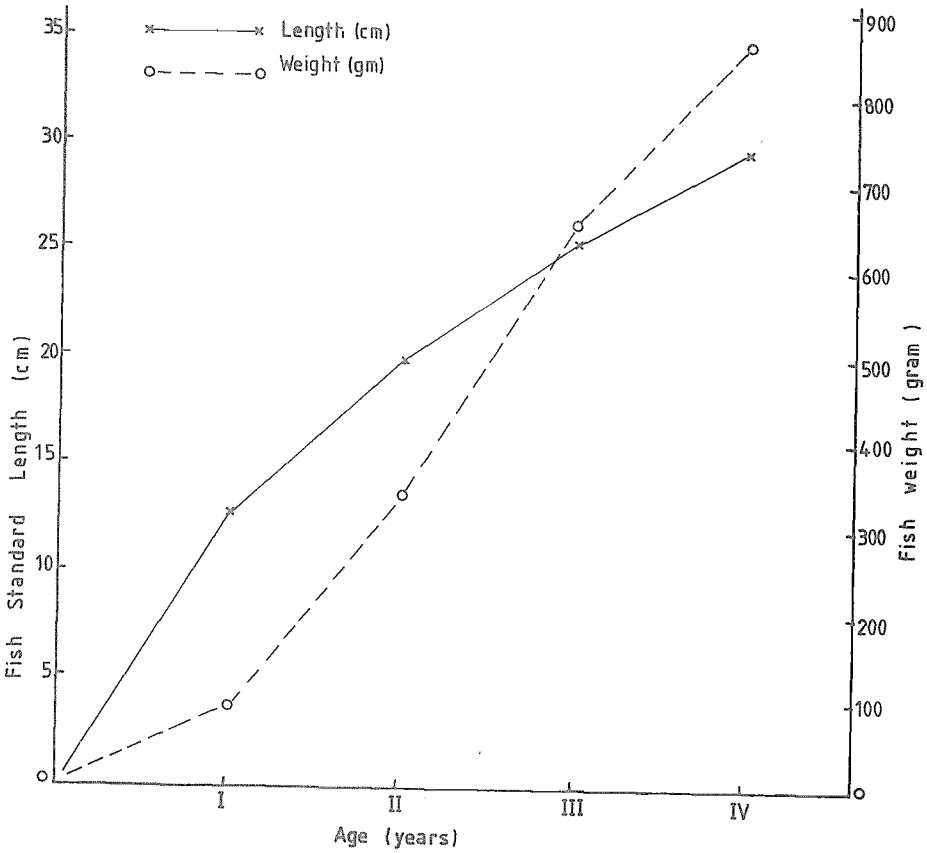
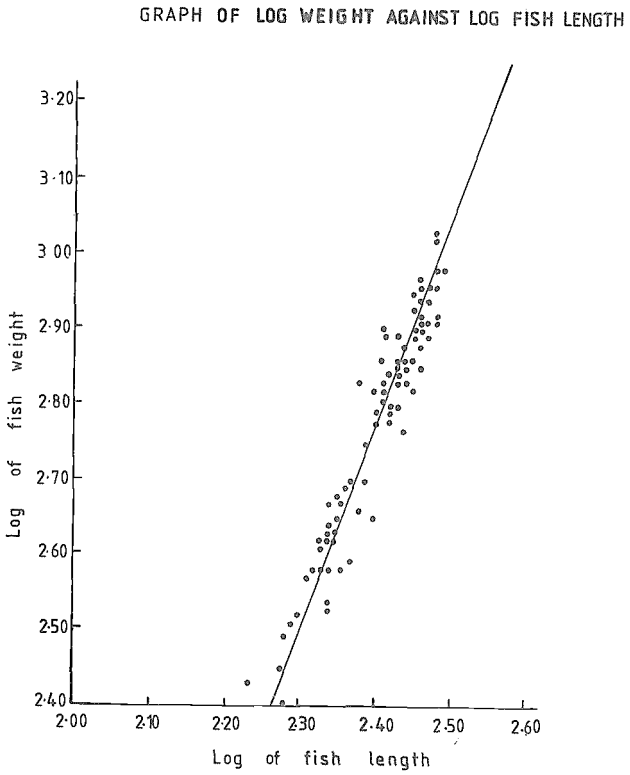


Fig. 2 Growth in length and weight for Sarotherodon niloticus in Opa Reservoir, University of Ife.



ig. 3 Log length/log weight relationship for S. niloticus in Opa Reservoir, University of Ife.

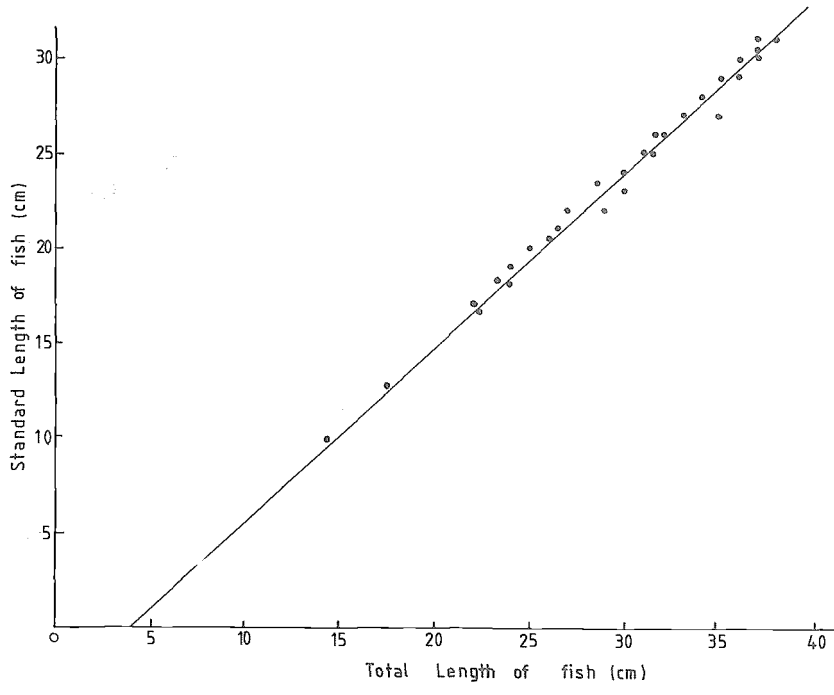


Fig. 4 Fish total length/standard length relationship for S. niloticus in Opa Reservoir, University of Ife.